

TURNBULL (L.)

TINNITUS AURIUM

OR

NOISES IN THE EARS.

SECOND EDITION, WITH CASES.

BY

LAURENCE TURNBULL, Ph. G., M.D.,

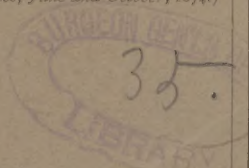
PHYSICIAN TO THE DEPARTMENT OF DISEASES OF THE EYE AND EAR OF
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OF "THE NATURE, CAUSES AND TREATMENT OF NER-
VOUS DEAFNESS," "A CLINICAL MANUAL OF THE
DISEASES OF THE EAR," ETC., ETC.

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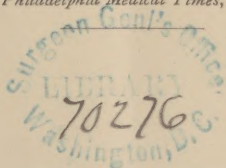
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PREFACE.

THE demand for the first edition having been far in excess of the supply, and the reception of the brochure having been of so flattering a nature both at home and abroad, the author has felt impelled by the importance of his subject, and a sense of duty to his profession, to issue a revised edition of his views in this most distressing of all maladies.

LAURENCE TURNBULL.

1208 Spruce Street, Philadelphia, August, 1875.

TINNITUS AURIUM.

THE ringing noises heard in the ears are not only a symptom of the diseased condition of the organ, but also a very troublesome form of disease in itself, for after all apparent disorder has passed, the patient is still distressed and disturbed by a most persistent form of tinnitus.

Each individual, although suffering from the same symptom, generally describes it according as it is suggested by his or her habits or occupation. The old lady, fond of her cup of tea, compares the noises to the singing of the boiling kettle; while the servant in the kitchen has a constant ringing of bells in her ears. The engineer will tell you that the noise is like a faint locomotive-whistle; the miller compares it to the whirr of the wheel; while the boiler-maker has a succession of knockings in his ears; the gardener or farmer talks of it as a rustling of leaves, or waving of ripe grain; the sailor, or dweller near the sea, identifies it with the roar of the ocean.

Then we have the agreeable forms, as in an old deaf lady, who informed the writer that she was often serenaded by lovely voices, and would inquire of her children if they did not hear the same sweet sounds. Another pleasant form noticed by a recent writer* was in the case of a middle-aged woman, who spoke of the noise as a low singing of birds.

* Dr. Dalby, of London.

There are some forms which, if neglected, become almost a mental malady, especially if the brain is diseased, or if there is a hereditary tendency in the family, but we have never known of a case of suicide from this cause, and our opinion is confirmed in a letter to the writer from Dr. Kirkbride, who for so many years has been the physician-in-chief of the Pennsylvania Hospital for the Insane in Philadelphia: "I do not now recall a case of insanity really owing to aural disease, although I think that defective hearing often aggravates some of the delusions of the insane, and disorder of the hearing-apparatus is not infrequent in insanity."

Dr. J. H. Worthington, physician-in-chief of the Friends' Asylum for the Insane (Twenty-third Ward, Philadelphia), thus writes: "I never knew a case of mental disorder which owed its existence to such disease (aural), nor any case of suicide in consequence of tinnitus aurium."

A similar opinion is expressed by Dr. John Curwen, physician-in-chief to the Pennsylvania State Lunatic Hospital, Harrisburg, who had also a long experience as first assistant-physician of the Pennsylvania Hospital for the Insane, at Philadelphia. He writes, "I do not recollect any cases of insanity under my care which were produced by ear-noises; all the cases of hallucination of hearing have arisen from diseases of the brain, induced in various ways. The three most decided cases now in my care are caused by intemperance and overwork, both mental and bodily, bringing on great cerebral disorder."

Von Trölsch,* in his work on the ear, says in regard to the tinnitus aurium of the insane, "It is a very important question whether the aural hallucinations occurring in insane patients do not frequently depend on peripheric tinnitus, which is

* Fifth German edition, p. 515.

exaggerated by the patients." It would be well worth the trouble of physicians for the insane to examine the ears of such patients. He further states, "I am indebted to my esteemed friend Prof. L. Meyer, formerly director of the Insane Asylum of Hamburg, for the history of a melancholic patient who was relieved of a sound in the ear (seeming to the patient to be the cry of a child) by the removal of a plug of inspissated cerumen, which caused deafness of one side. The patient, from that time forward, made a rapid and complete recovery."

Schwartz, an aural surgeon, and Köppe, a physician for the insane, have made this question a subject of investigation.

Schwartz says, "Subjective aural sensations, which are caused by demonstrable affections of the ear, may, in predisposed persons, especially when there is hereditary tendency to mental disease, become the direct cause of aural hallucinations, that may accelerate the outbreak of mental disease." He states that he treated such a patient for a long time, and she was protected from a threatened attack by the local treatment of the aural disease.

Dr. Köppe, before referred to, assistant-physician to the Provincial Insane Asylum at Halle, examined this patient with Dr. Schwartz, and was convinced that the treatment caused the above-mentioned results. In other cases, insane persons who suffer from aural disease distinguish its tinnitus from their illusions or hallucinations. They hear their "sounds" simultaneously, but independently, of the tinnitus aurium.

Dr. Köppe examined thirty-one insane persons in whom considerable disease of the auditory apparatus could be detected. In none of them was there tinnitus without at the same time the existence of aural illusions and hallucinations.

Seven insane persons also had chronic hyperæmia

of the vessels of the handle of the malleus, and, besides the subjective aural sensations, aural illusions and hallucinations. In two cases of inspissated cerumen, the tinnitus disappeared after the removal of the plugs of wax, but the *hallucinations remained*. In several cases, which are fully detailed, both the tinnitus and the hallucinations disappeared after local treatment of the ear. Two cases were particularly interesting, where only one ear was affected, and where the sounds were only heard on that side.*

Tröltsch† again states, "Perhaps we may designate the one variety as nervous tinnitus aurium, the other as material or acoustic, and which may exist at the same time."

William Harvey, F.R.C.S.,‡ mentions hysterical, hypochondriacal, and nervous patients, as suffering from every possible form of tinnitus. Wilde§ says, "In some forms of hysteria, and in cases of mental aberration and lunacy, as those familiar with such know full well, the patients often complain of all manner of noises, whisperings, and unnatural sounds, but these are, I believe, generally the result of a disordered imagination, like the ocular spectra which afflict certain individuals."

Saissy,|| in treating of symptomatic tinnitus, says it depends on "nervous diseases, such as hysteria, hypochondriasis, convulsions, and mental alienations."

Dr. O. D. Pomeroy,¶ of New York, made an examination of sixty lunatics at the Blackwell's

* Berliner Klinische Wochenschrift, 1866, Nos. 12, 13,—“Gehörstörungen und Psychosen.” Allgem. Zeitschr. für Psychiatrie, 1867, Bd. xxiv. Auszugsweise im Archiv für Ohrenheilkunde, B. iii. S. 332.

† Allg. Zeitschr. f. Psych., iii. 332.

‡ The Ear in Health and Disease, London, 1865, p. 25.

§ Diseases of the Ear, Philadelphia, 1853, p. 361.

|| An Essay on the Diseases of the Internal Ear. J. A. Saissy, Baltimore, 1829, p. 132.

¶ Transactions Am. Otol. Society, Boston, 1871, p. 44.

Island Lunatic Asylum, New York, thirty of whom had hallucinations of hearing, and thirty had none, with the view of determining whether diseases of the ear had any agency in the production of the symptoms, and his conclusions were as follows: "The result of the examination is a little in favor of the hallucination cases being oftener associated with ear-disease. The proportion is not, however, anything like that previously quoted from Von Tröltsch and others." "Neither was it possible to observe any connection between the tinnitus aurium and the hallucinations." Certainly, the aural disease did not, in a single instance, develop or excite the insanity, as has been quoted. This confirms our own examinations and correspondence, and gives a more hopeful and proper view of even the worst form of this affection. Our rule should be that if there is any hereditary tendency to mental disease, and there are persistent hallucinations resembling any of the forms we have given as examples, care should be taken that the ears be examined, and, if it be possible, this symptom removed. We cannot pass from this part of our subject without a short reference to the observations made by Nussbaumer, in which he attacks the physiological axiom that each organ of sense is capable of peculiar perceptions, which can be excited by no one of the other organs of sense. "The author himself, and his older brother, both have this peculiarity, that every perception of sound, either musical or otherwise, excites also a perception of light. His ear is so delicate that with the deep notes of a piano he is able to hear eleven over-tones, and with each one of these has a distinct perception of light. As children, he and his brother were in the habit of designating frequently the tones of different objects when struck, not by the sound, but by the color produced.

"To learn whether the perceptions of the two

brothers were always the same, a long series of questions, to be answered by each, was written, from which it seemed that, although each had a perception of light with each sound tried, the color of the light varied: being, for instance, for the note A, in one, dark Prussian blue, and in the other, dark yellow.

"The color was never seen externally, but, as he expressed it, his brain suffered from the action of a sound-wave in the meatus, not only the normal, but also such a change as produced in his consciousness an impression of color. When in concentrated thought, however, the perception of color might escape notice."

"In the discussion which followed, Prof. Benedict considered that the phenomena were not physiological, but pathological. Optical perceptions, as the direct result of acoustical perceptions, could only be pathological. Similar obscure diseases of the mind and brain were frequently observed in hysterical, hypochondriacal, and melancholy persons, but were not understood, as most physicians were unskilled in psychology. He predicted that similar observations to those of Nussbaumer would soon be reported, now that attention had been called to them. Finally, Prof. Benedict warned the patient against further observations on himself, lest the phenomena would overpower him, especially as it was evident that there was a hereditary tendency; possibly, heterotopia was the cause of the phenomenon."*

THE DIAGNOSIS AND CAUSES OF TINNITUS AURIUM.

The first and most frequent cause we shall notice is the pressing of a portion of altered cerumen

* Report on Otology, by J. O. Greene, M.D., from Nussbaumer. Reprinted from the Boston Med. and Surg. Journal, October, 1873, p. 9. Ueber subjective Farbenempfindungen die durch objective Gehörempfindungen erzeugt werden. Wiener Med. Wochenschrift, Nos. 1, 2, 3, 1873.

upon the membrana tympani. This usually arises from cold, heat, or moisture, or the three combined, detaching it from the side of the auditory canal and causing it to press on the membrane. The second cause is an elongation of the hairs in the external orifice of the auditory canal, passing across and interlacing with cerumen or epithelium scales, and when in the air producing a sound like an Æolian harp. In another form, the point of a single hair was found to rest upon the surface of the membrana tympani. A particle of dried pus on the same membrane gave not only a sound, but a disagreeable one, until removed.

A third cause is a small quantity of adhesive mucus on the inner surface of the membrana tympani, or middle ear, pharyngeal orifice of the Eustachian tube, or on the mucous membrane near the tube. These conditions are almost always attendant in acute, subacute, or chronic catarrh.

A fourth cause is a foreign body in the Eustachian tube, as, for instance, a beard of barley,* or a bullet.† In the first case, the beard caused otitis media purulenta, with most distressing noises, and was ultimately discharged through a perforation of the membrana tympani without the loss of the hearing, and with entire relief to the tinnitus. The bullet could not be removed. In a case related by Fleischmann, the result was not so satisfactory.

A man complained for years of a continuous sound in his ears and of a very peculiar sensation in his pharynx. He subsequently died, and on a post-mortem section a beard of barley was found projecting from the pharyngeal orifice of the tube, and reaching up into its osseous portion.‡

A fifth cause of tinnitus occurs synchronously

* Turnbull on Diseases of the Ear, p. 78.

† Ibid., p. 94.

‡ Ibid., p. 79.

with the action of the heart, and may be caused by *anæmia* or a diseased condition of the blood, or enlargement or narrowing of some of the numerous arteries or their branches in the vicinity of the ear. This narrowing occurs generally in a branch of the temporal, posterior auricular, or carotid arteries, and we can determine by pressure whether it depends upon them, after finding no physical cause in the ear itself.

A sixth class comprises a large number of doubtful cases, under the head of *nervous tinnitus*, in which it is conjectured that there is inflammation, irritation, extravasation, or disturbed circulation of blood in the labyrinth, cochlea, semicircular canals, auditory nerve, or reflected lesions of the brain.

The diagnosis in this class of cases is made by excluding all causes which would be at all possible to produce the sound in the external or middle ear.

The seventh cause is immoderate contraction of the tensor tympani muscle, which contraction not only moves the malleus and with it the membrana tympani, but also, if the contraction is excessive, draws the whole chain of ossicles inwards, and, as a consequence, the plate of the stirrup is pressed deeply into the oval window (*fenestra ovalis*), causing violent subjective noises from the intra-labyrinthal pressure. "Dr. Gruber* observes that the tensor tympani muscle arises from the cartilaginous portion of the Eustachian tube, but is connected with the tensor veli palati muscle by a tendinous prolongation in such a way that the intimate connection between the two is completed; and L. Meyer even asserts that he considers the two muscles as a single digastric muscle. It is well known how often this muscle suffers in the frequent diseases of the naso-pharyngeal structures. If we notice

* Tenotomy of the Tensor Tympani, by Prof. Joseph Gruber, M.D. Translated by Charles S. Turnbull, M.D., Phila., 1873, p. 23.

the soft palate and usually hypertrophied tonsils into which this muscle enters, we will see how the same is displaced and drawn out of its position, and it will be clear that this muscle in such cases is unable to properly perform its function—viz., the opening of the Eustachian tube; and this abnormality, sooner or later, will be sure to affect its companion muscle—the tensor tympani—and so cause the spasmodic contraction of the latter, which will exert a further influence upon the labyrinth.”

Now the question arises, Are there any positive symptoms by which we can with certainty diagnose in the living such a retraction of the tensor tympani muscle? We must answer most decidedly in the affirmative.

I will not speak of the anamnesia, and of the subjective symptoms, which certainly deserve some consideration, but pass at once to those positive signs especially apparent in such cases. In consequence of the peculiar connection between the malleus and the membrana tympani, that is, the lower end of the malleus with the adjacent portion of the membrana, it is directed inwards, while at the upper end the short process pushes it outwards; and there originate two folds, the posterior of which is much more distinct, running backward, while the anterior fold runs forward, and in the comparison of this bulging with the sunken condition of the membrane we have an important indication, which Dr. Gruber was the first to describe and employ in diagnosis.

When the membrana tympani is drawn forcibly inwards, the lower end of the malleus is drawn with it, while the upper end remains nearer its normal position, so causing the posterior fold of the membrana tympani to become more prominent, and we have at once an abnormal inward bulging of the membrana tympani. Of course, such a condition

of the membrana tympani can be produced by causes other than a contraction of the tensor tympani, but we possess very positive means of investigation for distinguishing other abnormalities which show the same pathognomonic appearances on the part of the membrana, and by exclusion we can make our diagnosis sure.

Since I have here considered the greater prominence of the folds of the membrane as a diagnostic symptom of the sunken condition, and as a phenomenon related to shortening of the tendon of the tensor tympani, I might also describe many others which are all caused by shortening of the tendon.

We know how to recognize and appreciate them, and, by a minute examination and some diagnostic acuteness, should seldom remain in doubt.

In this connection, I might mention a few of the symptoms which are here of great diagnostic value, but which, as it seems to me, have not been sufficiently appreciated by my colleagues.

These appearances are as follows: The handle of the malleus appears broader, the membrana tympani is twisted (*torquirt sein*), the axis-band of the malleus becomes more conspicuous, and the membrana tympani returns more or less rapidly, by retraction, into its former abnormal position, after the application of the air-douche had caused it to bulge outward.

The eighth cause is "Aspergillus in the auditory canal or on the membrana tympani;" this is a mould or fungus lining the auditory canal and membrana tympani. It causes inflammation and pain with a discharge as in otorrhœa, and, after syringing, of a whitish-yellow membrane which is frequently a complete cast of the external auditory meatus and membrana tympani. In every obstinate case of inflammation of the auditory canal, we should carefully examine the discharged material under the

microscope to be certain of the diagnosis. The symptoms are fulness of the ear, constant tinnitus aurium, and pain of a dull heavy character.*

PATHOLOGY.

We have noticed, under various causes, that "tinnitus aurium" results from affections of the external ear, both the anterior and posterior surface of the membrana tympani, cavity of the tympanum (middle ear), and Eustachian tubes, when closed by adhesive secretion or thickening of the mucous membrane, or from the opposite condition of being too open. The noises in the internal ear have also been confounded with an affection of the brain itself or its coverings. It is possible to have ringing noises in the ear even when there are, so far as our examinations can penetrate, no organic changes in any portion of the ear.

In the post-mortem examination of persons who have suffered from "tinnitus" for a long period without any disease of the middle ear, the appearances found on dissection of the petrous bone by Ménière,† Politzer,‡ Schwartz,§ and Hinton,|| are disease of the semicircular canals, ecchymoses in the vestibule, hyperæmia of the cochlea, general enlargement and fulness of the vessels of the labyrinth.

We must therefore for the present come to the conclusion that the semicircular canals and vestibule are also the seat of the diseased conditions above described, with now and then apoplexy or endolabyrinthic fulness of the labyrinth, showing more or less pressure within its walls or irritation of the auditory nerve.

* See paper by the writer on "Aspergillus," in Transactions Med. Soc. of the State of Pennsylvania, 1873. Diseases of the Ear, pp. 104-7.

† Gazette Méd. de Paris, 1861, p. 29.

‡ Archiv des Ohrenheilkunde, vol. ii. p. 88.

§ Ibid., Bd. i. p. 206.

|| Diseases and Injuries of the Ear, by Dalby, p. 182.

TREATMENT.

In the first class of cases to which we referred—namely, pressure from cerumen upon the membrana tympani—the treatment in the great majority of cases is simply to remove the offending cause by means of the injection of tepid water or weak solution of soda. Numerous cases of this class are relieved by this simple procedure; many of which are of a most distressing character.

The second variety is caused by excessive growth of stiff hairs in the meatus. The treatment consists in carefully cutting the hairs close up to their point of exit by means of curved scissors, and removing each one when cut. The objection to plucking them out is that it will frequently cause an abscess at the termination of the hair-follicle. Another form of this same variety is when a hair becomes detached and falls upon the membrana tympani, from which it must be removed by means of a camel's-hair pencil slightly moistened in glycerin.

The patient referred to in whom pus from an abscess was washed to the surface of the membrana tympani was a distinguished hospital surgeon, who caused it by attempting to wash out his own ear. When the syringe was properly employed in the hands of another, the pus was removed, and the tinnitus ceased.

The third variety of causes is when adhesive mucus is on the posterior surface of the membrana tympani, in the middle ear, or in the mastoid cells. This is removed by the catheter or a few blasts from Politzer's air-bag or douche; if these means are not effectual, paracentesis of the membrana tympani and washing out the middle ear with a weak solution of biborate or sulphocarbonate of soda in warm water. At the same time attention must be given to the naso-pharyngeal region, with the use of the nasal douche, sprays, and gargles.

In the fourth variety, or foreign bodies in the Eustachian tube, the treatment will be to reverse

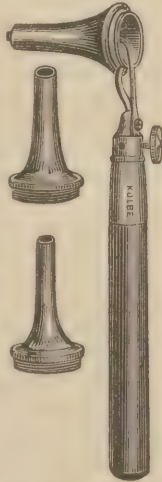
FIG. 1.



the action of the air-bag and withdrawing the air, or by means of an elastic catheter in the pharyngeal orifice of the tube, at the same time compressing the nostrils, or by means of a valved bag attached to a curved glass tube introduced through the mouth as near as possible to the orifice of the tube, and rarefying the air. If there be much swelling, thickening of the Eustachian tubes, etc., I have found the Eustachian forceps one of the most valuable instruments in making applications of stimulating agents, such as nitrate of silver, sulphate of copper, iodine, and carbolic acid, directly to the parts.

The annexed figures will illustrate the author's Eustachian forceps (Fig. 1), also the improved rheophore (Fig. 2); the first to make applications by

FIG. 2.



means of a fine piece of sponge charged with the fluid, either by the nose or under the soft palate to the Eustachian tubes. The second apparatus is placed in the auditory canal, which being previously half filled with warm salt-and-water, the metallic wire which projects is insulated by the vulcanite envelope. By means of the metallic screw a connection is made with the conductor of a gal-

vanic or inductive apparatus, and the circuit is closed by placing upon the mastoid process the other moist sponge, which communicates with the second conductor, and the galvanic current impresses not only the muscles but the portio dura nerve by means of a few fascicules of fibres, which constitute what Wrisberg called the "portio intermedia," forming a connecting link between the auditory and the facial nerve.

Should the foreign body produce inflammation, with effusion, bulging of the membrane, etc., its escape should be facilitated by perforation of the membrane by an aspirator-needle or Prof. Gruber's syringe.

In the fifth form, or pulsating tinnitus, the result of some alteration in the blood-vessels, anæmia, or excessive action of the heart, we must try compression of the temporal or carotid, diminishing the frequency of the heart's action by aconite or digitalis; or, if the patient is anæmic, administer the salts of manganese, or the lactate or citrate of iron, with good nourishing diet and out-door exercise, avoiding all forms of excitement, as dancing, violent exercise, or mental effort.

In the sixth class we must make a careful diagnosis by exclusion to discover whether we have excitement of the brain causing subjective noises, or on the other hand exhaustion of the brain from over-effort or some drain upon the nervous system. For in the first instance we resort to large doses of bromide of potassium, or, if there is any suspicion of syphilitic complication, add the iodide of potassium until we produce bromidism on the one hand or iodidism on the other, with its characteristic eruption.

If it is the second, from exhaustion, we resort to a solution of phosphoric acid employed in the form of a lemonade, or to the phosphites or hypo-phosphites, in conjunction with strychnia or its salts, with the use of the galvanic current to assist in completing the cure.

In the seventh class of cases the operation of tenotomy of the tensor tympani is to be recommended, and the mode of operation is that of Dr. Fr. E. Weber-Liel,* of Berlin, which we have here employed in a number of cases with more or less success, depending upon the cause.

In the eighth class of cases, which are generally the result of a patulous condition of the orifice of the Eustachian tube, the remedy should be the application of a powerful solution of nitrate of silver or sulphate of copper or carbolic acid to the mouth of the tube by means of the Eustachian forceps, and washing it by the use of the double Eustachian catheter, with the internal use of strychnia, to stimulate the muscle to contract and close the orifice.

The ninth class, or "Aspergillus;" the vegetable parasite or fungus is to be removed by the injection of spirits of wine or a warm saturated solution of sulphite of soda, and the discharge of mucus or serous fluid is to be checked by the use of an injection of a strong solution of sulphocarbonate of zinc. A number of these cases of a mild character we have treated after the summer season in patients who have allowed the sea-water to pass into the ears and dampen the hair. In these cases a mild solution of an astringent, acetate of lead or sulphate of zinc, will remove all the symptoms of itching, deafness, and distressing tinnitus, in a very short time.

Case I.—Tinnitus. The sounds resembling the action of a pump and the hissing of a snake, the result of impacted cerumen and the excessive use of tobacco.

Henry L., aged 30, residence Philadelphia, occupation painter, complained of deafness, with sounds

* Tenotomy of the Tensor Tympani, by Fr. E. Weber-Liel, Lecturer on Otolaryngology, University of Berlin. Translated by Laurence Turnbull, M.D. Pamphlet, pp. 14. J. Moore, Phila., 1873.

like the hissing of a snake and the action of a pump. The patient uses tobacco to excess, both smoking and chewing. He is so deaf in the right ear that a loud-ticking watch is only heard in close contact. Left ear almost normal in hearing. On examination of right ear the meatus is found covered with patches of altered cerumen, while the membrana tympani is entirely covered with a concave mass, as if melted by heat. There is not much doubt that by its pressure it first displaced and caused absorption of the air in the middle ear, driving the malleus inwards and pressing the stapes into the fenestra ovalis. Directed a warm solution of biborate of soda, in equal parts of glycerin and water, to be dropped into the meatus warm for three nights, and on the morning of the fourth day the parts were washed out by means of the syringe. This procedure did not give entire relief until fresh warm air was blown in by Politzer's apparatus, when the concave membrane assumed its normal character, and the deafness and sound disappeared.

Case II.—Fluttering tinnitus with deafness of one side since June, 1873; the result of bathing. Treatment for two weeks with almost entire relief.

Oliver W. L., aged 14, student, Berks county, Pa., sent by Dr. E. B. Shapleigh, of Philadelphia. General health good, pulse rapid, no valvular murmur, no enlargement of heart; has constant fluttering noise in left ear; never free, night or day. Mother deaf in both ears, from cold; no other member of the family deaf. Deafness and noises commenced in June, 1873; no discharge, no pain. Left ear—hearing-distance, $\frac{3}{8}$; right, $\frac{3}{8}$. No disease of auditory canal or membrana tympani. Right Eustachian tube open and free; left contained inspissated mucus. The naso-pharyngeal mucous membrane

swollen, and considerable discharge from it. Treatment prior to coming under the writer's care, washing out ear, applying counter-irritation, oils, etc., but with no benefit. Treatment first two days, inflated the middle ear; slight relief. Finding the mucus tough and somewhat dry, resorted to Lucae's plan of injecting a few drops of a solution of chloral hydrate (10 to 30 grains) to f3j of tepid water into the middle ear by means of the Eustachian catheter. This was disagreeable, but not painful; after ten applications, as the results did not afford permanent relief, omitted it, and employed the nasal douche with warm solution of common salt, alternated with solution of zinci sulphas in water, to wash out any accumulation in the naso-pharyngeal space. This relieved him, but only temporarily, and was continued for four days, followed by the use of the galvano-magnetic current, applied by the author's modification of the rheophore of Duchenne. The insulated conductor was passed near to the membrana tympani through a warm solution of chloride of sodium. This gave him considerable pain, but entire relief from the noises, with improved hearing in the left ear, so that he was able to resume his studies.

Case III.—Tinnitus the result of chronic catarrh, with depressed membrana tympani (deafness).

H. G. H., aged 40, native of Pennsylvania; merchant, doing business in Philadelphia; has suffered from constant noises in the left ear, with deafness to low sounds, for years. General health impaired, loss of appetite, and much depression. Applied to the writer December 25, 1873, being recommended by Dr. Levis of this city.

History: frequent attacks of cold in the head; employed tobacco, and had all the symptoms of

follicular pharyngitis, with nasal catarrh, using a number of handkerchiefs each day, and expectorating disgusting masses of altered mucus, which was hardened, and in some instances tinged with blood. The left Eustachian tube was narrowed and diminished in its power of opening during deglutition, and the hearing in the left ear to $\frac{1}{3}\frac{2}{6}$; in the right the hearing was $\frac{1}{3}\frac{5}{6}$, and the tube more free. In the right membrana tympani there was sub-acute inflammation, and handle of malleus injected, with short process very prominent and membrane sunken. Left, no symptoms of inflammation, but deeply-sunken membrane.

Prior to his coming under the writer's care, this gentleman had been under the treatment of almost every quack in this city, and had spent a large sum of money without benefit. He had also been treated by a number of able medical gentlemen, regular members of the profession.

The treatment of the throat, pharynx, etc., was continued until the patient ceased to have the constant discharge. The sunken membrana tympani was elevated by means of Siegle's aural speculum, and the middle ear was medicated with various solutions, restoring it to a more healthy condition. It was still found that the sounds were moderated, but no definite change in the "tinnitus."

May 8, 1874, performed tenotomy of the tensor tympani after Weber's method, and placed the patient on the use of a mixture of spiritus terebinthinæ; this was followed by no great change in the sounds. On the 12th, injected through the opening, which had not closed, a warm solution of sulphate of zinc, gr. iij to fʒi of water. This was done by fitting the nozzle of the syringe to the meatus by means of an extra india-rubber packing. The syringe was very carefully and gradually employed, until the fluid passed by the nostril. This was

followed by a dull, heavy pain, and the patient felt faint; relieved by the application of the air-douche, one-fourth grain of morphia by the mouth, and the inhalation of chloroform. He complained also of a crackling like the breaking of bubbles of air; still no permanent relief of the noises, which he likened to those of a boiling tea-kettle.

Faradization was then tried; for several weeks he had the fly-like noise in the ear, but when the application was withdrawn he was no better.

Having tried all the ordinary means of relief, and the throat being improved, middle ear free, membrana tympani raised, I placed the patient upon a supporting and stimulating treatment for his brain, by the use of diluted phosphoric acid, with iron, with decided benefit, while I simply kept the orifice of the Eustachian tube free from mucus by the posterior nasal syringe and solution of common salt. To correct the fulness of his head and constipation, I directed Oak Orchard Salts, a mild saline aperient. This latter treatment he has been under, and he feels freer from the noises, is in better spirits, and is now able to say that he feels better than he has felt for years.

During my absence in the summer, 1874, he visited my friend Dr. Cohen by my request, who tried the constant current with much the same results as those obtained by faradization, so that he fell back upon the same treatment under which I had placed him.

Case IV.—Tinnitus the result of collapse of the Eustachian tube, without deafness.

B. N. B., M.D., aged 34 years, residence Philadelphia, applied April 7, 1874, to the writer, suffering with a buzzing noise in the right ear. This was of four months' duration, and the blowing sound increasing as if into a bottle. It disturbed

his sleep, and he was unable to perform his duties with comfort or satisfaction. He had consulted four physicians, and, having some sore throat, all the remedies were applied to it.

On examination, found the hearing of both sides normal, membrana tympani of the right slightly drawn inwards, but no prominence of the handle of the malleus, with no opacity of the membrana tympani. The left Eustachian tube was free, and air passed into the middle ear without any difficulty. The right was found obstructed in the pharyngeal orifice, which the writer endeavored to overcome by the use of the air-douche and Eustachian catheter, which were followed by slight improvement. A few days after, a Eustachian bougie was introduced by the aid of the rhinoscopic mirror, and an application made to the orifice of the tube, of equal parts of diluted carbolic acid and tincture of iodine. This treatment was continued, and removed every trace of the noises. The bougie was a metallic one, acutely curved, introduced by the mouth, and its use was to stimulate the mucous membrane lining the tube, and thus remove the collapse and swelling. This bougie was introduced only into the wide portion of the tube. These bougies are employed from No. 2 to No. 5 of the French scale, and it is well to remember that the distance from the widest portion to the mouth of the isthmus, or narrowest part of the tube, is seventy-four millimetres, and the distance from the point to the tympanic cavity eleven millimetres, and the width of the cavity thirteen millimetres.

Another case of much the same character came under the writer's notice, but the results were not so satisfactory, owing to the length of time which elapsed before the patient applied for relief. It was as follows:

Case V.—Isabella V., aged 25, resident of Phila-

delphia, a lady of education, and very intelligent, applied May, 1874, stating that she was suffering with a constant buzzing sound without deafness; thought it was due to the result of a very severe cold; no pain. On examination of the offending ear, which was the right, found her hearing was $\frac{1}{3}$ left, right $\frac{1}{3}\frac{4}{6}$, showing an amount of deafness by the watch which was not noticed in hearing the human voice. In the right meatus there was an excess of cerumen, the removal of which improved that ear to $\frac{2}{3}\frac{9}{6}$. The right membrana tympani was found normal. Left membrana tympani sunken, and Eustachian tube of left side closed by a dark mass when it was examined by the rhinoscopic mirror. This was removed by the nasal douche, and the iodine and carbolic acid applied to the ulcer which was found under it. A strong solution of common salt alternating with a solution of sulphate of zinc was then directed to be employed at home.

May 22.—Returned, and expressed her thanks for the relief afforded; she was so much improved as to be able to sleep, and was almost free from the tinnitus unless much excited. She has been under the care of an aural surgeon of this city for three months, who had employed a large Politzer's air-douche at each visit, and the application of the constant current to the ears, which, she stated, instead of improving her had only increased her distress.

We have now and then very favorable results from the galvanic excitement in isolated cases, as may be noticed by a reference to the author's statement of cases of nervous deafness treated by Brenner's formula;* yet Brenner states that he had failed in seventeen cases of tinnitus. In a carefully prepared paper by H. Schwartze,† of Halle, he observes, "I am far from denying favorable effects of

* Turnbull, Clinical Manual of the Diseases of the Ear, p. 389.

† Archiv für Ohrenheilkunde, March, 1874.

the galvanic excitement in isolated cases, but I have not been able to convince myself at any time of any real and permanent results from galvanization. . . . Moreover, we must remember that a series of (more recent) ear-troubles, also of such whose causes must be sought for in the cranial cavity, are capable of a spontaneous cure. Whoever has not frequently convinced himself of this fact is apt to over-estimate his therapeutics. The physician who is in the habit of treating all diseases by the preference of one remedy, as, for example, electro-therapeutics, of necessity over-estimates the results of his favorite remedy." See *two cases* of tinnitus aurium reported as treated with success by Dr. Thos. F. Rumbold, by the galvanic current, with zinc and carbon battery of eighteen, ten, seven, and four cups, after local medication by solution of muriate of ammonia, and also by a solution of carbolic acid and ext. pinus Canadensis into the pharyngo-nasal cavity by spray-producer, with inflation continued for two and a half months. The doctor avoided the opening reaction of the anode. His conclusions are as follows: "In nearly one-fourth of my cases electricity has been either a valuable adjuvant or a specific."—*Arch. Electricity and Neurology*, vol. i., May, 1874, p. 54.

Dr. Seely, of Cincinnati, in an article on the use of galvanism in ophthalmic and aural affections, states his opinion in reference to the latter: "My attempts thus far have been rewarded by more hopes than practical results."—*Arch. Electricity and Neurology*, vol. i., Nov. 1874, p. 221.

In the same journal, vol. ii., May, 1875, Prof. Benedict is reported to have stated in reference to tinnitus aurium: "This disorder is best cured by the galvanization of the great sympathetic in the neck and the so-called external application of the galvanic current,—*i.e.*, one electrode applied to the

ear, and the other, as a wet compress, placed around the forehead of the corresponding side. Frequent inversions of the direction of the current are useful." *One successful case is reported.*

George P. Field, M.R.C.S., Aural Surgeon to St. Mary's Hospital, and Lecturer on Aural Surgery in the Medical School, London, has published a paper on "Tinnitus Aurium" (8vo, cloth), read before the Harveian Society of London. We have not seen the paper, but take the following abstract of a notice of it from the *Medical Press and Circular*, July, 1875:

"The remedies used in times past are touched upon, and finally the treatment which he suggests—namely, faradization of the membrana tympani and of the intrinsic muscles of the ear—is illustrated by recording some fifteen cases under treatment, together with the results obtained.

"He uses Dr. Stöhrer's double-celled induction apparatus, and passes the current directly on to the membrana tympani by means of a vulcanite speculum with a piece of platinum wire passed through it and attached to one of the wires of the battery. As the speculum is not actually in contact with the membrana tympani, a silver probe is made to touch the platinum and at the same time the membrana tympani. A very weak current is applied at first, and gradually strengthened. If the current is too strong, hemorrhage or acute pain may be the result.

"The fifteen cases reported are from among cases treated by Mr. Field at the hospital, and have therefore been shown to and explained to the pupils of the medical school.

"Without going into a description of the cases, it may be sufficient to say that in all various noises and singing in the ears gradually disappeared under the repeated application of the current, and that in all the deafness decreased, as shown by the distance at which the watch could be heard."

Case VI.—Extreme deafness, with noises, from sun-stroke.

Henry C. K., aged 44, has suffered from complete deafness of eight years' duration; supposed cause, sun-stroke. He had applied cold water to his head after exposure to the intense heat of the sun; no pain; says he has ordinary noises in the ear. His deafness commenced in California. Has also granular pharyngitis, extending into Eustachian tubes, with ulceration of the mucous membrane lining the vomer. Left Eustachian tube closed. The right Eustachian tube is pervious, but much narrowed. Cicatrix on left membrana tympani. Right membrana tympani more normal in appearance. Watch not heard on either side. Tuning-fork heard only on temporal bones. The patient having tried all manner of treatment without success, the writer perforated the membrana tympani, and, with Weber's improved tenotome, divided the tendon of the tensor tympani, with the assistance of the resident physician of Howard Hospital, Dr. Parish. The operation was followed by pain and a few drops of blood.

Directed oil of turpentine, ten drops every three hours, in mucilage of gum arabic, until all the acute symptoms had disappeared; electricity was then applied by Dr. Warrington, who has furnished the following notes of the case:

July 21.—First application of electricity. Stöhrer's battery, six cells. Cathode in ear; anode in right hand. No impression.

July 22.—Eight cells. Slight sensation of sound.

August 1.—Eight cells. Continued to apply electricity six times a week, about the same force and the same effect; hearing constantly improving. The throat treated by scarification and application of tincture of iodine and glycerin, equal parts. Im-

provement. Internal treatment, iodide of potassium from four to eight grains three times a day, combined with tincture of columbo or ginger. Also chlorate of potash, \mathfrak{z} ij; tincture of chloride of iron, $\mathfrak{f}\mathfrak{z}$ ij; syrup, $\mathfrak{f}\mathfrak{z}$ j; glycerin, $\mathfrak{f}\mathfrak{z}$ j; water, $\mathfrak{f}\mathfrak{z}$ iiij.—M. Tablespoonful doses three times a day. The patient felt so much better that he desired the operation of tenotomy of tensor tympani of the other ear.

September 20.—On performing the operation, he was immediately deprived of the power to hear words in that ear. Inflammation and suppuration followed. Eustachian tube became very patulous. On speaking into the ear, words were seldom distinguished, but the sound was intense and distressing. Throat more inflamed. Injected the ear with sulphate of zinc, gr. iii; sulphate of morphia, gr. i; water, \mathfrak{z} i. Symptoms of improvement, and some return of hearing. In three weeks applied electricity, eight cells, slight effect.

October 10.—Throat improved; hearing in right ear good, also in left ear.

December 11.—Hearing for sounds better than at any time since the operation. Throat well; able to hear words in conversation better than ever before.

Case VII.—Concussion, with extravasation of blood into labyrinth, terminating in an acute attack with deposit in the mastoid cells, with deafness and severe tinnitus of left ear.

Edward McH., native of Wales, aged 45. He stated that, when passing up the Mississippi River during the war, on the flag-ship "Hartford," under Commodore Farragut, a cannon was fired immediately over his head, the left ear being towards the gun. So close was he that his hair was burned. He immediately became insensible, and, on arousing in

about an hour, found himself very giddy, and with pain in his head, but not in the ears. Nausea and vomiting were present, and occasionally occurred during the following two or three days. Prior to this accident he could always hear well, and never had any trouble with either ear. Since the accident, the left ear has been almost completely deaf, but at no time has he had tinnitus in the left ear. At the same time, hearing diminished in the right ear, but was not abolished.

About September 15, 1873, right ear lost almost entire appreciation of sound, when tinnitus and buzzing supervened.

About October 1 a purulent discharge appeared in right ear.

October 27.—At present both membranes perforated; left apparently drawn in; purulent discharge from right meatus. Had both washed out, and applied argenti nitras in solution.

October 30, 1873.—Hearing improved in right ear; left ear still very deaf; perforation of right apparently healing; that of left still very large. Solution of argenti nitras passed into left ear; it is felt in the pharynx, and is tasted by the patient.

November 2, 1873.—Hearing much improved in right ear, but severe pain in it and mastoid cells and over right side of head, with swelling. I punctured the swelling down to the bone with a bistoury, giving severe pain at the time, and causing the man to become quite pale and faint.

November 6.—Returns entirely free from pain. Hearing much improved, and tinnitus entirely gone. Patient much pleased with result.

Case VIII.—Concussion, with symptoms of extravasation of blood into labyrinth or semicircular canals.

During the summer of 1864 Dr. Parish saw a soldier in apparent general good health, very deaf,

and with constant and great tremulousness of head and upper extremities chiefly, but also to some extent of lower extremities; very giddy on attempting to walk, and gait very unsteady. He stated that a few days previously, while lying in front of the breast-works, a heavy cannon was fired in close proximity to him, and that the ball passed but a few feet from his head. He was instantly rendered unconscious, and continued so for a few hours. On returning to consciousness, found himself in condition as above. He was on his way home on furlough when Dr. Parish saw him, and he was not again heard from.

Case IX.—Congestive tinnitus, the result of working at a heated furnace with head bent to one side; all the ordinary remedies employed, with tenotomy of the tensor tympani; no improvement.

Margaret A., aged 36, an intelligent woman, living as a domestic, applied at Howard Hospital with intense tinnitus. She has had charge of a large furnace; while looking into and raking it when in full blast she was suddenly seized with headache, giddiness, and noises on the side nearest the heated part, in the winter of 1871. She consulted Dr. H., a young and intelligent physician, a resident of one of our large hospitals, who syringed her ear, giving her quinia, etc., but with no relief. She then visited the Philadelphia Eye and Ear Infirmary, and was under the judicious care of the aural surgeon of that institution for some time, but his treatment was of no benefit to her. Came to Howard Hospital in January, 1873. A careful examination was made, and the Eustachian tubes were found open in both ears. Right ear, the one in which the noises disturbed her, the membrana tympani was retracted, with axillary rotation of the handle of malleus; no

catarrhal trouble in pharynx. After employing all the local remedies, as the air-douche, injection by the double catheter, and washing out Eustachian tubes, also injecting into the middle ear solution of potash and hydrate of chloral, with no benefit, she was advised to have perforation of the posterior fold. She willingly consented, and returned on April 10. The writer then perforated the posterior fold of the membrana tympani, in the presence of Dr. Mathews, resident physician in Howard Hospital (1871), and passed a warm solution of bicarbonate of soda, by a closely-fitting air-tight syringe; this gave her considerable pain, and she was ordered a solution of zinci sulphas, gr. iii to the ounce of warm water, to be applied at night, also a quarter of a grain of morphia if in pain, with extract of hyoscyamus applied around the ear. The perforation kept open for one month, but with no relief to the noises.

On May 5, 1873, I performed tenotomy of the tensor tympani, and applied electricity to the pharyngeal orifice of the Eustachian tube. The patient did not complain of much pain. I directed a mixture of spiritus terebinthinæ, etc., as advised by Weber-Liel.

On the 12th of May I injected the middle ear with solution of zinci sulphas, gr. vi to ʒj aquæ, which gave her pain; directed hydrate of chloral to relieve her.

She returned to the hospital on the 15th, 18th, 21st, and 29th,—no improvement. On the 29th she desired to have the operation repeated, in hopes of some benefit; this was again done. She suffered but little during the last operation; no bleeding as at the first operation. She could pass air by the perforation, but there was no improvement in the noises.

Called at the hospital, by request, in six months.

December, 1873, still troubled with the noises; no impairment of hearing since the operation. No pain. Membrana tympani shows two spots of opacity. Able to attend to her duties; is as well as before the operation.

Case X.—Complete deafness, with no tinnitus; not any loud sounds heard, and no articulate sounds recognized even by the use of the most powerful ear-trumpet.

A. H., aged 55, a lawyer by profession, and a gentleman of fine literary taste and philosophic knowledge, applied to the writer during the winter of 1873. The history of his case was as follows: He gradually lost his health, and with it his hearing, about one year before he applied; he still heard sounds when he placed himself under the care of a physician of this city, who, he stated, first introduced steam into his middle ear, and then blew cold air, which was followed by total deafness (doubtful). When he came to the writer he was under Prof. Agnew's care for his general health, and the writer made but a casual examination, and advised him to continue, and found both Eustachian tubes open,—one more than the other,—with dense opacity of both membrana tympani, without tinnitus, showing complete paralysis of the auditory nerve. In partial paralysis we have subjective or pseudo-subjective sensations. This patient again presented himself in the fall of 1874, and was very desirous of having something done for his hearing. His health was improved, but with the improvement no sounds were heard. We had therefore to inform him that no means that we knew of would be of any benefit to his hearing. His only brain-symptom was vertigo.

Case XI.—Deafness, but hearing by the use of the ear-trumpet; tinnitus with distressing vertigo; patient relieved by the operation of tenotomy of the tensor tympani.

The following are the notes of this case: George B., aged 45, Princeton, Indiana, applied May 16, 1874. Has been a merchant in the neighborhood of Pike's Peak; was a soldier for one year, but was discharged on account of his deafness and his liability to fall from dizziness. History: has had no children's diseases, but had intermittent fever for ten years, with enlargement of the spleen. Has never had any pain in his ears, but on one occasion accidentally struck his left ear with much force, and had a discharge of yellowish pus for one week. In the year 1859 heard as well as any one; became interested in a mill, when, owing to exposure, his hearing began to leave him. He became a soldier, but he could not hear the fife or drum; and yet he could distinguish some of the low notes of the piano but none of the upper notes; could hear the human voice in his own ear-trumpet, made by himself, of thin platinum in the form of an auricle, which was so light in weight that he balanced it in one ear. The treatment he had been under consisted in syringing the ear, and soon after it was followed by a pulsating noise in the left ear, which was at first intermittent, but after a time became constant. He had in his right ear sounds like a letting-off of steam. He had been under physicians at his home and in New York City. Examination: external meatus normal; chronic inflammation of membrana tympani of left ear, with injections along the handle of the malleus, with deposit of lymph and adhesions. This was evidently the effect of the blow. Right membrana tympani injected, with depression, with deposit of lymph on the vessels along the handle of

the malleus. Rhinoscopic examination of the orifices of the Eustachian tubes: left, open and patulous, with enlarged glands; right not so much open. Tuning-fork heard best in the right ear; left not so perfect, showing conduction of the bones of the head, and not entire paralysis of the auditory nerve, as in the other case. Examination by exhausting the air by Siegle's pneumatic apparatus repeatedly applied, afforded no relief to the pulsating noises. Pressure by shutting the nose modified them somewhat. Faradization with the sponge on wire insulated produced a sound like that of a fly on a window-pane; on increasing the power the pain became much more intense under the ear and in his teeth, but no relief to the tinnitus. By the use of the author's double otoscope, heard the sound of the air in the right Eustachian tube loudest.

May 26, decided to operate by tenotomy of the tensor tympani, and to break up the adhesions as the only chance for relief. This was performed at Howard Hospital, assisted by the resident physician, Dr. J. Barr (1874), and in the presence of two medical students. On perforating the drum, there was some difficulty in dividing the tendon of the muscle, which was unusually thick and resistant, and the patient experienced considerable pain, owing to the adhesions which had to be broken up by passing the knife under them. To prevent inflammation, the ear was carefully covered up, and a mixture of terebinthinæ spiritus and ammonii chloridi given three times a day.

Reported same day: parts looking very well and open; all pain ceased by 7 P.M. the evening of the operation. Feels relieved of a certain disagreeable sensation in his head (vertigo),—feeling of falling.

May 30.—Still continues well; injected a solution of one grain of sulphate of zinc through the opening; not much pain; this was repeated twice.

The patient left for his home in a few days after the operation, and when he arrived the writer received the following letter from him, in which he states, "I arrived at home all right; no trouble with ear. The left Eustachian tube is now more open than it ever was; hearing about the same in both ears; had no trouble with my head since the operation."

I gave him certain instructions to be carried out, also advised a more extended trial of the faradic current, as Brenner's formula had been obtained by its use in our first experiment with his deaf ear. This, it is true, is rather like a confirmation of Schwartze's second conclusion, "that Brenner's normal formula is obtained in absolute deafness;" but there must be no tinnitus, for we have no such result in cases where there is absolute paralysis of the auditory nerve (see Case X. before referred to).

The following are the conclusions of the eleven cases reported: four were cured, two much improved, two improved, one not improved, and two not treated. One of those not improved is a form of deafness accompanied with distressing noises, where the patient apparently was in sound health a few hours before; this is followed by apoplectic symptoms, with giddiness, and is due to hemorrhage into the labyrinth, and is known as Ménière's disease. The same results shown in another from injury may occur from fracture through the bony labyrinth by contre-coup. In one we had absolute paralysis of the acoustic nerve, with little or no tinnitus.

"Nolet,* of Leyden, has made experiments concerning the origin of pulsating tubular noises which have been so much discussed, the main results of which are here given, because they are important. Vascular or pulsating noises are produced in tubes

* Tröltsch, *Ohrenheilkunde*, Fifth (German) Edition, p. 507. Nolet of Leyden (see *Archiv für Heilkunde*, 1871, xii.).

of equal calibre, if the velocity of the current be great; and this velocity must be the greater the smaller the diameter of the tubes and the smoother their walls. The rougher their walls are, the sooner will noises be produced. If there be a strictured place in the tube, a noise becomes perceptible already at a rate of velocity when there would be no noise perceptible if the narrowing were not present. When the velocity of the current was considerable, a quivering was to be felt before and behind the strictured place, which was more readily produced in tubes with thin walls than in such as had thick walls. When the tubes were partially widened, noises were produced in them by a greater velocity of the current (? translator). The noises are produced by the viscidness (vertices of the fluid), and not by vibrations of the walls of the tubes nor by rhythmical friction (?) of the out-flowing jet."

The treatment of such pulsating noises is of two kinds: first, constitutional treatment if the disease depends upon thinness of the blood or a want of certain elements; these must be supplied,—if from want of iron, by chalybeates, if from want of fibrin, by wheat, etc.; if the other important elements are wanting, blood in some form itself, as the expressed juice of beef, like Valentine's, or by lamb's blood taken warm. If the blood is too thick or viscid, it must be reduced by salines. If the noises are very distressing, resort may be had to nervines and agents that will control the violent action of the heart, as aconite, digitalis, with chloral hydrate or fluid extract of valerian, *Prunus virginiana*, or water of the bitter almond or orange-flower. Mechanical means are also to be tried, by compressing the jugular vein over the highest point of the hyoid bone. The observations of Benedict, Türk, and Politzer confirm us in the opinion that pressure over the mastoid apophyses would, in some instances, modify

these subjective noises. By removal of the narrowed condition of the meatus auditorius, as performed by Larrey and Cloquet, or by some mechanical and surgical means as related in the author's work, p. xvi. In a certain class of cases of chronic catarrh of the middle ear, Politzer has recommended the closing of the external meatus by wax or cotton charged with wax. Schwartz employed for the same purpose a ball of gutta-percha oiled, softened by means of warm water, or, as the writer prefers, gas-heat and olive oil. Lucae has employed and recommended the rarefaction of the air by fitting the external meatus with an instrument like Siegle's pneumatic apparatus, especially in catarrh of the cavity of the tympanum. The condensation of the air in the auditory canal by the same instrument gives, sometimes, good results in cases of pressure of the stapes, or stirrup, over the fenestra ovalis, or oval window.

Then follows puncturing of the membrana tympani, recommended as early as 1722, and first received into favor as a legitimate operation in surgery about the year 1800, for deafness and sounds in the ear. We have repeatedly performed this operation, and in certain cases with success; again, we have operated with no relief to the noises. Schwartz, who has performed this operation over one hundred times, has established it in cases where there has been an accumulation of mucus, blood, or pus. He prefers a transverse incision in the posterior and inferior part of the membrana tympani. Dr. Lucae* has also resorted to this operation in the treatment of deafness and noises, by a division of the posterior fold or pocket for the purpose of reducing the tension of the membrane of the drum. Where he has had the peculiar rattling sound de-

* Dublin Journ. Med. Sci., Oct. 1871, p. 322.

noting a collection of secretion, which is also to be perceived by a sufficient transparency of the membrane, after cutting the posterior fold, he extends the cut to about the middle of the membrane, in order to facilitate the escape of the not unfrequently very viscid and tenacious secretion. He has performed this operation (division of the posterior fold) up to 1870 forty-eight times in forty-five cases, as follows: First, in cases without demonstrable adhesions, fourteen operations: greatly improved, seven; a little improved, seven; not at all improved, none. Second, in expressed otitis media adhesive, twenty-seven operations: greatly improved, five; a slight improvement, eleven; not at all improved, eleven. Third, in genuine catarrh of the cavity of the drum, at the same time letting out the secretion, seven operations: of these, six were greatly improved, one a slight improvement. Politzer performs the same operation by incision of the posterior fold (not pocket) of the membrana tympani. His incision is a longitudinal one, at right angles to the long axis of the fold between the short process of the malleus and the peripheric end of the fold.* Of the operation of tenotomy we have already given our experience in the cases above reported.

* Monatsschrift für Ohrenheilkunde, Jahrgang ii. p. 51.

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